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ABSTRACT

Although all New Zealand polytechnics and institutes of technology are making some use of new information technology and Internet-related technologies, developments incorporating effective use of these new technologies and media remain somewhat uneven. Educators seeking to embrace the Internet as a delivery medium face numerous critical design issues. To address these issues, managers and educators should take the following actions: (1) recognize the overall strategic importance of new technology developments to their institution and plan accordingly; (2) analyze staff needs and arrange access to required training and resources; (3) adopt a cooperative, collaborative approach; (4) choose technologies appropriately, giving more weight to those with human-like features and using them in ways that can become more transparent and less intrusive; (5) use a prototyping approach and the interactive, cybernetic quality embedded at the heart of Internet technologies to build and maintain effective learning environments; and (6) closely involve students in development of their own education. (The bibliography lists 24 references. Appended is a report on the results of a survey administered when this report was first presented to determine audience members' existing levels of knowledge about and use of the technologies described at their own institutions.) (MN)

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Crossroads of the New Millennium

Responding To The Challenges Of Internet Technologies And New Media: Issues For Polytechnics And Institutes Of Technology

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Abstract

The rapid and widespread changes that have occurred in most aspects of tertiary education in New Zealand have posed challenges for both educators and administrators at polytechnics and institutes of technology. There are similar trends occurring in other countries. Growth opportunities, alliances and mergers, and strategies for remaining financially viable, are topics as often discussed now in educational institutions as those relating to pedagogical and course design issues.

The ongoing, rapid development in information technology and its potential for supporting existing and new forms of course delivery is a very topical issue and one that probably presents the greatest current challenge for staff. Every polytechnic and institute of technology in New Zealand is making some use of new information technology and Internet-related concepts such as e-mail, discussion list servers, browsers, web pages, chat, intranets and associated new media forms are now recognised throughout the sector.

However, observation indicates that developments incorporating effective use of the new technology and media to support course delivery are still somewhat uneven. In addition, at management level some institutions may not be viewing such use of technology as important in a strategic sense, or have a visible plan for managing its long-term development.

This paper examines the communication design issues faced by educators who choose or are required to use course delivery mechanisms mediated by new technology, in particular Internet-related information technology. It suggests a number of approaches to help educators come to terms with the challenges of using new media forms effectively, and for institutions to consider as part of strategic planning processes.

Responding to the Challenges of Internet Technologies and New Media: Issues for Polytechnics and Institutes of Technology

INTRODUCTION

If we accept that great potential exists to transform teaching and learning with new technology, and sufficient evidence now exists to satisfy the convicted positivist, the radical constructivist and just about everyone in between, the question remains as to why more visible progress has not been made some 40 years after the 'revolution' began? (Gunn, 1998, p.134).

So what progress has actually been made? Every polytechnic and institute of technology in New Zealand is making some use of new information technology and Internet-related concepts such as e-mail, discussion list servers, browsers, web pages, chat, intranets and associated new media forms are now recognised throughout the sector. However observation indicates that current developments incorporating effective use of new information technology and media to support course delivery and provide learning opportunities are still somewhat uneven. In addition, at management level some institutions may still not view such use of new technology as crucial in a strategic sense, or have a visible plan to manage its long-term development.

Over the past decade, many radical changes to the education system were implemented in New Zealand. Terti ry institutions struggled with decreased direct government funding, the two-edged sword of autonomy/accountability and increased demands from "clients" for both more flexibility and better quality. Growth opportunities, alliances and mergers, and strategies for remaining financially viable became topics as often discussed in institutions as those relating to pedagogical and course design issues.

In the midst of these changes to institutional structure and the formation of new alliances, new information technology, with its perceived potential to help institutions meet set objectives, appeared to provide some real opportunities. Administrators perceived new technology developments, particularly those associated with the Internet, as providing opportunities to cut course delivery costs and increase revenue, while educators recognised the promise of various new information technologies and media forms to enhance and expand learning opportunities and improve the quality of education programmes. Tiffin and Rajasingham (1995) described a new technology-facilitated education model which created fundamental change in the way educative processes were managed, and predicted a number of subsequent benefits.

In reality, the continuing flood of information about what new technology is available and where and how best to implement it, created sensory overload for administrators and academic staff alike. Blacker (1988, cited in Hearn, Mandeville and Anthony, 1998) argued that the key issues for information technology implementation would no longer be technological efficiency but understanding and working with the power structures that governed its use, its integration into day-to-day management and communication processes, and beyond mere integration, the changing of the fundamental nature of these processes. It can also be argued that support for the introduction of new information technology as a cost-effective strategy without attention to critical design factors for successful implementation and use in an educational context, provides no long-term benefits to institutions.

The current environment in New Zealand has been one in which tertiary education, although encouraged, has been primarily viewed as a "private" good, an economic indicator, and the responsibility of individuals. In this deregulated model, institutions were expected to compete and make a profit. This approach now appears likely to undergo at least some modification due to the recent change of government, although complete details are not known yet. However, it is clear that the new government is interested in changing the way in which the tertiary education sector operates and the way in which institutions relate to each other, and that it wishes to see the development of a much more co-operative and cohesive model.

This paper examines some of the promises of new Internet-related technologies and attempts to suggest some ways for polytechnic educators to come to terms with the challenges of using these new technologies and media forms, within a more co-operative and collaborative environment.

PROMISES AND PROBLEMS OF THE NEW MEDIA

The very nature of the new technology provides both promises and problems. Strangelove (1994) described the Internet as a "distributed and open systems technology. *Distributed* meaning that it has no central location and *open* referring to the fact that the operating codes are not proprietary or secret. Everyone can contribute to the design and development of the overall system." (p.7).

Tapscott (1998) argued that there has been a fundamental shift occurring in technology from relationships based on force to relationships based on open acceptance. The co...pt of

education changes in the move from the paradigm of teacher as transmitter of information to students learning through discovery and new media. The teacher's role is still critical, but changing - to structure the learning experience, motivate, provide context, and integrate disciplines. "N-Geners who are used to interactive learning will be increasingly unsatisfied with the old model. As they enter the workforce as teachers and policy makers, they will bring the new paradigm of interactive learning with them." (p.290).

In similar vein Spender commented:

> In the electronic world, we don't have knowers: we have *users*. The transition has been going on for the past few decades: the role of the teacher as authority figure and knower has been in decline as the amount of available information expands. As most teachers are print-reared, and as only a relative few have made the shift to the new media which is now the business of the world, the gap between what teachers know and what is electronically produced is forever widening. (1995, p.102)

The primary challenge for the polytechnic tutor/lecturer has always been to create effective learning environments that support student learning and facilitate learning experiences appropriate to some specific set of objectives. This has always been part of the work of teachers. Many polytechnic educators originally came from industry, trade or professional careers, rather than from academic backgrounds, although this is changing as the range of courses widens to include degrees. Most have received some training in how to teach, but this has often emphasised vocational training techniques and practical applications of these within specialist areas, rather than theories of learning and teaching or instructional design models and techniques.

The most difficult part of creating effective learning opportunities is in the design of courses and the learning environment - it is here that media are chosen and implementation planned, in order to meet relevant objectives. It appears that initial changes in course design and delivery involving the use of new information technologies and media forms have most often been introduced by enthusiastic staff members acting on an individual basis, or within groups operating at the teaching level, using their own time, and bringing skills and knowledge acquired from elsewhere, often self-taught. This mode of development can have critical implications for consistency and quality control.

Three stages in the use of Internet-related technologies can be identified, although these are not discrete stages, and may not represent linear development. There is also an overlap

between the way the technology may be used in the course design and course delivery processes. The first stage involves the use of e-mail: messages between colleagues, communication swapping and sharing of information, discussion lists, tutor/student communication, student/student communication. The new medium has different characteristics to other forms of communication: it is fast, asynchronous, anywhere/anytime and informal. Users appear to learn to communicate in the medium by using it, as there may be little or no formal instruction in its use or protocols.

Bridgeman, Stewart and Bridgeman (1995) described a successful pilot project to teach the Advanced Certificate in Business Computing to students in Taumaranui using distance education techniques, from the Taranaki Polytechnic main campus in New Plymouth. The main medium of communication used was e-mail, as this was a proven technology, would be cheap to implement, and required minimal training of staff and students. Phase Two of the project identified plans to establish an e-mail listserver, and add audio/graphical/video links.

The project report concluded:

> It appears very likely that in the not too distant future we will see a change in the present format of existing Business Computing Tutor jobs, brought about by decreasing government funding. Possible new ways of course delivery using the new technologies will require that innovative strategies be adopted if tutors are to survive in the new environment. (Bridgeman et al, 1995, p.13)

The second stage involves the use of browsers: web-based material, home pages, chat and so on. This stage most reflects current polytechnic use of Internet-related technology, and provides the greatest challenge for educators at present. Many individual tutors, who have acquired some knowledge and skills in the new technologies, are attempting to translate existing course material into new media forms. Much of this work shows interest and desire to incorporate new forms of media, but some critical issues emerge: for example, dumping existing print-based material straight into web page format is not the best use of the medium, and as yet there appears to be a shortage of appropriate design skills.

Brennan (1998) identified the process followed by one tutor, and how difficulties were faced and resolved. The biggest problem appears to be the lack of adequate development time to fully appreciate the demands and requirements of the new media and learn how to design for it, underpinned by uncomfortable feelings of many tutors that their young students have a

much better grasp on the technology than they do. As Spender commented "Young people are *doing* information and learning. They want to have information literally at their fingertips, and to be able to work it, move it around, play with it, rather than keep it in their heads and deliver it on cue." (1995, p. 108).

It is at this stage that great misunderstandings can occur between administrators who glimpse the potential of new forms of delivery, and the tutor who must develop and deliver the promise. Chamberlain (1997) examined opportunities in telelearning in a mythical polytechnic, and identified a range of expert skills and knowledge that would be required for effective development. Albertson and Selwood (1997) identified professional development for teachers as a crucial requirement in order to "maximise the opportunities that technology dreams foretell." Tiffin commented "The freedom that information technology can confer on the student of the future must also be conferred to the teachers of the future. (1991, p.7).

The third stage of Internet-related technology use involves applications of virtual reality, hyperreality, artificial intelligence and so on, and provides both the biggest promise for education innovation but also the biggest challenge for incorporation in course design and delivery. These applications are only at the beginnings of their development, and have huge cost implications both in time and money. They involve high interactivity mechanisms, and require high levels of collaboration between users and developers. Conley (1998) discussed the globalisation of education, and described the development of collaborative, interactive environments supported by use of new media. Again, the crucial issue of adequate training for tutors is identified:

> The difficulty of this objective is not in its technical feasibility but in the education of educators in how to design, prepare, and utilise such non-linear forms of material. It is in the technology of creating materials and aiding educators and students to create and utilise non-linear materials that the true pragmatic challenge lies. (Turoff. 1995, cited in Conley, 1995, p.27)

Issues identified earlier also impact on the promise of the new technology and the potential for this to be realised: the competition for resources within institutions, the struggle for control between technologists and educationalists, and the limited appreciation of the strategic importance of new technology. Alessi (1997) asserted that many educators now focus directly on the use of electronic technology for instruction instead of examining what

people now need to know and learn, and where this learning might take place, and then reframing this within appropriate technology.

Dr John Hinchcliff, President of Auckland Institute of Technology (now Auckland University of Technology), in a recent address to New Zealand polytechnics' chief executives, argued:

> It is not so difficult to put programmes directly on to the Internet and other computer-based technologies. It is a different proposition to make use of the full capacity of these technologies for significantly changing the way learning is organised and delivered. This process is expensive, requires significant structural development and organisational change ... (1999, p.3).

Gaining clear and objective information about relevant new technologies and their capability to provide support for education delivery can be difficult and time consuming. Commercial companies continually receive advice and information about the newest technologies and methodologies from vendors, although by contrast, many vendors have less interest in the education market because it appears to have relatively limited spending power. "...teachers have mostly missed out on the promise (and the reality) of digital media, because the tools are too expensive and there's no quantifiable 'return on investment' to justify them." (Dyson, 1998, p.106). However, these attitudes are changing as education is seen increasing as a business and a marketplace, and many hardware and software companies are now developing arrangements with education providers that range from sponsorship to business partnerships. Microsoft, IBM, Computer Associates, Aoraki Corporation and Rational Software are among organisations that have offered special product pricing arrangements to NZ polytechnics.

Critical Design Issues

Negroponte argued "The big changes in computers and telecommunications now emanate from the applications, from basic human needs rather than from basic material sciences." (1995, p.76). There are some critical communication design issues to be faced and resolved in ensuring we design for education rather than designing for technology. The following issues are identified for discussion:

- Determination of the educational objectives first, then consideration of appropriate technology, not other way around.
- Development of flexible, interactive, collaborative and supportive environments.
- Cybernetic aspects - importance of considering feedback and incorporating changes.

- Time required to learn, reflect and integrate an awareness of the new media. This is a particularly important design issue, and two points offered for consideration by Hearn, Mandeville and Anthony are relevant here. ".. while the highway may represent an evolutionary leap in communications hardware and software, the psychological capacities of individual users have not similarly evolved. ... the issue of individual identity in virtual societies is particularly relevant." (1998, p.37).
- Human interface design aspects.
- Dynamic aspect to systems.
- Aspects of chaos - underlying patterns to be discovered.
- Virtual environments.
- Responsiveness to individual needs/choices.
- Transparent technology - enabling, unobtrusive. Range includes multimedia, Internet, Intranet, MUDs, MOOs, videoconferencing, videos, CD-ROMs, interactive software, PDAs, smart cellphones, wireless telecommunications, wireless LANs.
- Continuing technology convergence
- Evaluation: academic standards, credibility
- Portability of qualifications
- Range available of study options/delivery modes/physical locations/times: "anywhere, anytime, lifelong learning."
- Rules, regulations, protocols (including documentation management and controls on access to material).
- Ownership and intellectual property issues.
- Support for applied research to inform and improve practice.

SO HOW CAN WE LEARN? WHERE AND HOW TO START?

> In an electronic era, an education system, which is based on what people keep in their heads, is doomed. If there is one thing that computers have taught us, it is that heads are not good places for keeping information in. In comparison to electronic retrieval systems, heads are poor retrieval systems. (Spender, 1995, p.105)

The best answers may lie in the technology itself: much of what we need to know can be found with the help of the very technologies we need to learn about. In experiencing how others are using the media to communicate, and in teaching ourselves and colleagues, we will teach what we most need to learn. There are numerous excellent resources that can be

accessed online that both demonstrate and teach design skills. A number of designers recognised internationally are accessible online. Jacob Nielsen's *Alertbox* pages are informative, easy to read and access, and are grounded in ongoing research. Other designers such as Bruce Tognazzini, Keith Instone and Rachel McAlpine offer comparable insights. The connecting links to others carrying out similar work in many different countries are endless.

A mentor/buddy/apprentice system could provide an effective and supportive model. At present, educators often work alone and do not show their material to others unless there is some institutional requirement to do so. Gunn (1998) makes the point that consultation and collaboration between colleagues become crucial in a field that is advancing as rapidly as education technology, where the speed of developments usually means it is not possible for one person to keep up with the state of play in all aspects.

Open, interactive systems, incorporating automatic peer review, including students as part of the evaluation, providing loops for immediate feedback: these cybernetic mechanisms create environments that reflect chaos theory and fractal effects. The underlying patterns emerge as prototyping begins to produce something dynamic that works. Brown (1997, 1999) presented a working model for the delivery of course material that focused on the basic needs and wants of users and incorporated genuine feedback mechanisms, enabling continued change and improvement. Verhaart (1998) described successful results using a similar model of development for designing and building such prototypes. Referring to concepts first developed by Tiffin and Rajasingham (1995), Chamberlain (1998) outlined a systems approach, using as a model the education system as a communication system.

SOME ACTIONS FOR CONSIDERATION

And where will educators find time for this learning and creative development? In these times of tight staffing ratios and decreasing funding, time for design and development work may be difficult to achieve, however some time may be gained through flexibility in class sizes and delivery modes. Theoretical material can be delivered in lecture format to large groups, with smaller sized practical workshops following. Self directed, self paced learning material can be delivered in a number of ways, for example printed workbooks, CD-ROMs, and online. Audio/video recordings of lectures and other sessions can form part of this material.

As identified earlier, people need training in developing and presenting material in new ways. For many institutions, the allocation of adequate time and funding to support professional development and training in new areas, particularly development of skills in instructional design, is a critical issue. In support of this Hinchcliff (1999) argued: "Staff development is an absolute requirement. A systematic and sustained programme of staff development will have to be organised to ensure colleagues understand the conceptual factors requiring changes in our educational delivery." (p.8).

Spender commented 'Helping teachers to cease teaching what they were taught - that's the revolution.' (1995, p.116). However, helping teachers to cease teaching *how* they were taught may be the more crucial point. Under stress, teachers fall back on the ways they were taught. "..new media don't always change the old mindsets." (Spender, 1995, p.118).

A number of possible courses for action emerge from consideration of the design issues and current research in this area. Note that it is not merely a question of thinking and planning. Educators will learn best by experiencing and working with these new media, and in recovering from mistakes. Feedback is the critical component. The aim is self-directed, self-corrected, self-improved, life long learning patterns of thinking. The following suggestions are for consideration by both managers and educators:

- Recognise the overall strategic importance of new technology developments to the institution and plan accordingly. Include relevant objectives in strategic and business plans. Allocate adequate budget. Develop infrastructure to provide appropriate support.
- Analyse staff needs and arrange access to required training and resources. Those more aligned to the use of print media will need time to move into the new design paradigm. The aim is to help staff acquire relevant design skills together with a better appreciation of new media capabilities. Recognise the relevance and importance to the institution of the concept of "life long learning," and allow for this continuing requirement in professional development expectations for staff.
- Employ a co-operative and collaborative approach: form user groups, and share, learn, talk and work together; avoid re-inventing the wheel; build effective links to other institutions rather than repeating information everywhere; use the technology itself to create ways to use it more effectively.
- Choose technologies appropriately, giving more weight to those with interfaces that have human-like features, and use them in ways that can become more transparent and less intrusive. If the new technology is too dominant, too important, too intrusive, and not

subject to the end-user's real needs, there is a danger that essential communication will be lost in the noise and distortion created by the new technology's processes.

- Use a prototyping approach and the interactive, cybernetic quality embedded at the heart of Internet technologies to both build effective learning environments and maintain them.
- Closely involve students in the development of their own education. Increasingly the line between teacher and student is blurred. Students must be involved in creating their own learning experiences, but also can contribute as young designers using media with which they are already familiar.

CONCLUSION

> Many young people already operate in the new medium. (They have not had to make a transition: it's the way their world works.) They understand that information is freeflowing (in the ether) and that the issue is to access it. (Spender, 1995, p.106)

This paper examined some of the issues relating to new information technologies and new media. A question was posed: "Why does progress in adopting new information technology to support teaching and learning activities still appear to be relatively slow and uneven when the promise has been evident for some time?" For many educators, even those very motivated and interested in using new media for course delivery, the pace of development appears to have been too fast and the learning curve required to become an expert user too steep for comfort.

In similar fashion to the difficulties experienced by many in learning a new language later on in life, people whose first learning and teaching experiences focused strongly on print-based media may struggle to use new media forms. Their paradigm is translation, translating their understanding of educational concepts and their existing material into the new media forms, rather than having the ability to think, imagine and design directly within the new forms. For others, the main difficulty has been the unavailability of any allocated development time in which to learn these new skills and create new material.

It is clear that the continuing development and refinement of new information technology, particularly Internet-related, will provide ongoing opportunities and challenges for polytechnic educators in the design and delivery of courses. The often quoted statement,

attributed to Microsoft's Chairman Bill Gates, that we overestimate what new technology developments will happen in the next two years, and underestimate what will happen in the next five, appears to present a reasonably accurate picture of what is currently occurring in New Zealand as well as other countries.

In order to be able to work effectively with new media that will continue to be developed, educators will need time to integrate these new ways of knowing into their consciousness and feel comfortable using them. The use of new media forms must incorporate interactivity and cybernetic mechanisms from the beginning, and all feedback should be given serious consideration.

This new paradigm of development allows all parties to be involved, and significantly blurs the roles of teachers and learners. Allowing time for reflective thought and integration is critical, together with support from collegial mentors who are going through similar processes. The development of real and virtual environments that support collaborative work, research and learning will be crucial. Institutions must recognise the strategic importance of new technology developments in the support of innovative education delivery and budget accordingly. As Hinchliff argued, adequate professional development is an absolute requirement for staff to move successfully into new development models, able to make effective use of the new technologies and media and to resolve relevant instructional design issues.

So it all takes time and resources, much more than was first thought would be required. It seems that issues relating to effective use of Internet-related technologies and new media for supporting education delivery still pose some problems for tertiary institutions. Failure to face these issues may lead to institutions losing credibility as providers of up-to-date and relevant education and at worst, may seriously threaten their viability. The critical challenges for polytechnics and institutions of technology in New Zealand are to recognise the importance of these issues and develop appropriate strategies for their resolution.

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APPENDIX

Presentation of Paper at Interactive Workshop

The presentation of this paper at TEND 2000 formed part of an interactive workshop. As the paper's main points were summarised, workshop participants identified and discussed key issues and concerns relating to the use of Internet-related technologies and new media. Some information about the experience of New Zealand polytechnics and institutes of technology in this area was included.

At the end of the workshop, participants completed a brief survey on existing levels of knowledge and use of these technologies in their own institutions, and identified possible barriers to the effective development and use of these technologies to support education delivery. This survey was also made available to other conference attendees after the workshop.

Issues and Concerns Identified by Participants

- Ongoing staff development

- Intellectual property and copyright issues
- People or technology – which first?
- Fear of technology/fear of job loss
- Slowness of existing technical infrastructure
- Teachers' ability to keep ahead of their students
- How people learn best in a web-based environment
- Development of effective online learning environments
- Effective online delivery of technical/practical subjects
- Online student support models
- Role of independent learning centres
- Information literacy
- Education and training for technicians or technologists?
- Accreditation issues
- Development and maintenance of standards

The New Zealand Experience

A brief examination of the online presence of New Zealand polytechnics and institutes of technology was completed prior to the TEND conference. This indicated that all 24 institutions have websites, although these vary in content and complexity. When questioned, ten (42%) indicated they had a functional intranet or that this was either under development or consideration. Nine (38%) indicated they were offering online courses. The experience of one institution, Whitireia Community Polytechnic, in establishing a strategic focus for development in this area, was described.

Possible Barriers to Development Identified

- Lack of knowledge and skills
- Gaps in technical infrastructure
- Lack of relevant software resources
- Limited technical support
- Little or no recognition of strategic issues
- Limited funding available
- Lack of access to relevant training
- Limited development time allocated
- Resistance to change

Survey Results

Initial analysis of the survey questionnaire indicated the following:

- Internet access appeared to be widely available for staff and students.
- Intranets were reported as under development by the majority of respondents.
- Strategic planning by institutions for the use of information technology appeared to be variable.
- There was a wide range in the levels of understanding and use reported of various technologies and media.
- The barriers to effective development identified as the four most important were:
    - Limited development time allocated
    - Limited funding available
    - Lack of knowledge and skills
    - Lack of access to relevant training

CONCLUSION

The original issues raised in this paper were reflected closely in similar issues and concerns raised and discussed by participants at the workshop. It appeared that educational institutions shared many issues in common and would benefit from consideration of the strategies suggested in the paper for consideration:

- Recognise the overall strategic importance of new technology developments to the institution and plan accordingly.
- Analyse staff needs and arrange access to required training and resources.
- Employ a co-operative and collaborative approach.
- Choose technologies appropriately.
- Use a prototyping approach with effective feedback mechanisms.
- Closely involve students in the development of their own education.

Workshop participants were thanked for their active involvement, their willingness to share experiences and their openness in identifying real issues and concerns.